The Builder.

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SATURDAY, JUNE 21, 1845.

LAST week we examined the report recently made to her Majesty by Sir Henry De la Beche and Mr. Thomas Cubitt, chiefly so far as it related to the fall of the mill at Oldham, appending thereto, some general suggestions of great practical importance with which the report concluded. Relative to the former, however, we omitted one remark which should not be passed over; and that relates to the far too common custom of placing the boilers of steam-engines within the factories themselves, rooms filled with the workers being above them.

The Commissioners say justly, they consider this mode of placing the boilers (adopted chiefly to make the most of the space), very objectionable, remembering the accidents which have happened in such cases through the carelessness of the engine-man, or from imperfections in the boilers or the pipes connected with them. "Where the boilers so placed are near the street, as was observed to be the case in a factory now erecting in Manchester, the danger of loss of life is increased, since accidents from explosion may not only cause the death of those employed in the factories, but of those passing in the street. This is a point to which we would earnestly request attention when Building Acts may be under the attention of the legislature."

Mr. Hodgkinson, in his evidence, pointed out several instances in point wherein considerable loss of life was caused.

We proceed to extract that part of the report which refers to the failure of the part of the prison at Northleach. It appears that an addition having been considered desirable for the purpose of containing six prisoners, a plan for a small building was prepared by Mr. Fulljames, the county surveyor for Gloucestershire, and a contract to execute the works was entered into by Mr. Thomas Haines, of Cheltenham:—

"The building was to have been 28 feet long, 25 feet wide, and 22 feet high, divided into six cells, 13 feet by 7 feet, having stone walls, with brick arches for ceilings. The arches covering the lower cells were 4½ inches thick, rising 10 inches in a width of 7 feet. The upper arches were 9 inches thick with the same rise. The height of the cells on the ground floor to the crown of the arch was 9 feet 3 inches, and in the upper floor 9 feet.

The building was commenced in the middle of May 1844, and carried on until the accident on the 13th of November, when the whole had so far advanced, that the upper arches were finished, and a covering of concrete laid upon them.

According to the evidence of Mr. Pugh, clerk of the works, the lower arches were finished when the building was up one story, and the upper arches were constructed when the walls were sufficiently high, which was about the 7th of September. The arches were built with mortar.

There were no ties or braces across the arches of the lower story, but two iron ties, each divided into three portions, crossed the upper arches, so as to divide their length into three equal portions. These ties were fastened to the side walls, and those dividing the cells, by means of iron plugs sunk into large stones, and secured into them by lead, the plugs coming through eyes or holes at the end of each portion of the ties. The ties were placed above the arches. The arches are described as having been put in during good weather, but subsequently much rain prevailed and soaked through the concrete above the arches and through the latter, so that the whole was in a wet state.

A crack was observed on the north-east corner of the building, at the latter end of October, and this was watched. It would appear that at the beginning of November the arrangements for tying the upper arches were considered, under all the circumstances of the case, insufficient; for orders were given to insert other ties which should connect the side walls through the springing of the upper arches. It was while John Aust, a mason, was employed making a scaffold for preparing holes to pass braces or ties across the building on the 13th of November, that he considered the arch above him unsafe, and before he went to his breakfast he marked it, to see if it were settling. On his return, he saw that the arch had sunk a quarter or half an inch, and of this he apprized the clerk of the works, who called off the men from their labour. This was scarcely accomplished before the six arches fell, and fortunately without injury to those employed on the building.

We attribute the fall of this small addition to the House of Correction at Northleach partly to the insufficient arrangement of the iron ties, placed too high for the strain, and partly to the want of protection of the building from the long continuance of wet weather, the rain having softened and partially washed out a portion of the mortar of the arches. From these circumstances, and the wet and unconsolidated state of the walls, there was no sufficient cohesion of parts to resist the general pressure, the walls were forced so far out as to permit the upper arches, with their load of unconsolidated concrete, to fall on the lower arches, and these readily giving way, the six arches were destroyed, leaving the walls in a damaged state. But for the effect of the rain the arches would probably not have fallen."

It is due to the architect to state, as it appears in evidence, that the contractor was bound to protect the building from the weather, and that the ties were not placed at the spring of the arch because they would then have appeared in the cells, which was highly objectionable.

The erection of fire-proof buildings, by means of iron-girders and brick arches, is becoming general, especially in Manchester and Liverpool, and it is of the utmost consequence that sound information on the subject should be disseminated. "The increase of fire proof buildings at Manchester," says Mr. Fairbairn, "has been steadily progressive in this district for the last thirty years, and I have no doubt, as the security and durability of these structures are better understood, that a much greater increase will take place; and that eventually every description of public building, and probably dwelling-houses may be constructed fire-proof.

At Liverpool, they have commenced building the warehouses fire-proof, and I can see no reason why the principle should not be extended to almost every description of building, particularly public edifices, such as the Houses of Parliament, Royal Exchange, &c., which, in my opinion, should have been constructed with cast-iron beams and arches, and *made perfectly secure from fire*.

Generally speaking, I am averse to legislative interference with the industrial resources of the country, but in cases such as cotton mills, and large public buildings, wherein numbers of people are congregated, the utmost caution should be observed in the structure, and probably it might add to the public safety as well as the security of property, if some controlling power was at hand, to advise and correct mistakes, in which the most perfect and well meaning are sometimes involved.

The greatest danger, however, arises, not from any desire to save expense, but from fancied security in people trusting either to their own knowledge of subjects they do not understand, or, what is still worse, to the gross ignorance of mere pretenders, whose position and opportunities for information precludes their advancement in either theoretical or practical science.

A knowledge of the strength of materials, and particularly of cast-iron, is but imperfectly understood; it is a subject which requires great labour and deep research, and even with those who have devoted the greater part of their lives and fortunes to these inquiries, it not unfrequently happens, that their labours are not always appreciated by those whom they are intended to serve; when I use the word appreciate, it is not in the sense that individuals and the public are indifferent to the value of such discoveries; but the force of prejudice, and attachment to preconceived notions, which in many cases are absolute imperfections, induce many to forego considerations of this kind, and to shut their eyes against demonstrative truths, calculated on the one hand to save considerable outlay in the cost of material, and what is of much greater importance, the security of life and property on the other."

As respected the arrangement of columns, beams, and tie-rods, it was impossible to lay down rules which would provide for every contingency. Mr. Fairbairn observed "that in fire-proof buildings for manufactories, the sectional area of the tie-rods should not be less than three square inches for every 20 feet in the width of the mill, and for warehouses and similar buildings five square inches will be a fair average proportion.

The walls should, in my opinion, never terminate with less than two bricks thick on the top story, and for every two floors downwards the increase should be an additional half brick, including an extra thickness of 4½ inches in the walls of the ground floor. For factory purposes the above proportions will be quite sufficient, but for warehouses and other buildings calculated to sustain heavy weights, an additional half brick in thickness to every story, terminating at the top with two bricks as before, will insure perfect safety. With these proportions, care must, however, be taken to flush or grout the walls; using at the same time the proper bond, and spreading the base of the foundations to at least one and a half times the thickness of the walls in the bottom story."

To shew the importance of scientific knowledge, it will be sufficient to mention, that a beam with a single flanch at the bottom thus ⊥, which will support a weight equal say to 1,000, may be broken if reversed and the flanch put upwards, thus ⊤, with a weight equal to 340.

"It is well known, or it ought to be known, to every person giving instructions for the form and construction of iron beams, that the strength is nearly a proportional of the section of the bottom rib or flanch; and, according to Mr. Hodgkinson's experiments, a bottom flanch of double the size will give nearly double the strength.

These facts having been proved by direct experiment, it is important to all those concerned in the construction of fire-proof buildings, in which the lives of the public and the property of individuals are at stake, that the form of beams and the section of greatest strength should be *perfectly and thoroughly understood*; and, to those unacquainted with the subject, we would beg to refer them to Mr. Hodgkinson's paper on the strength of iron beams, in the fifth volume, second series of the 'Memoirs of the Literary and Philosophical Society of Manchester.'"

In every description of arch supported by iron beams, it is essential to have the tie-rods as low as possible; it is generally inconvenient to have them in the line of the chord of the arch, or at the bottom flanch of the beam, but they should never be higher than the soffit of the arch.

The strength of cast-iron columns is very little understood by builders; they use them of certain dimensions, because they have been used before of that size and have not failed; the difference in their strength which is found

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